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U. S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE

ANNUAL REPORT

JORNADA RANGE EXPERIMENT STATION

1 9 2 8

By R. S. Campbell and R. H. Canfield

GOVERNMENT PRINTING OFFICE

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JORNADA RANGE RESERVE

ANNUAL REPORT AND PROGRAM OF INVESTIGATIONS

FOR 1928

Administrative Features

Organization of Work

The Jornada job analysis for the Personnel Classification Board field questionaire showed that approximately fifteen per cent of the working time at the Station is spent in administration. With eighty five per cent of the working time available for research, a reasonable balance between administration and research is maintained, but with the present limited personnel, little opportunity is left for expansion in either line of work.

Personnel

Of the permanent men at the Station, Campbell is taking educational leave from January to June, 1929, to make further progress toward his doctorate degree at the University of Chicago. Canfield has been chief of party for the new Jornada reconnaissance, and is acting director during Campbell's absence. Canfield plans to take nine months scholastic leave next year to secure a master's degree at the University of Nebraska.

With both Campbell and Canfield working for higher degrees, it would be highly desirable to have another technical man desiring post graduate work assigned to the permanent staff next June, so that two men would be available each winter while the third is taking post graduate training. Such an arrangement would give all three men a much better opportunity to secure graduate work, and would undoubtedly result in better, more fundamental research at the Station.

Gordon D. Merrick, a Junior at the University of Chicago, was hired in June as temporary field assistant. In order to help with the reconnaissance, he stayed on the job until December 15, and then returned to school. Merrick displayed remarkable ability in grasping the work, particularly in the botanical investigations. In order to broaden his experience, he should have a temporary position next summer, either with a forest experiment station, or on a national forest.

Administrative Details

The response of the District to a call from the Jornada for administrative details was indeed gratifying, and is certainly appreciated by the Station staff. Ranger Thomas of the Lincoln, was timely in his visit, in that he was the means for carrying on the field work withoun interruption during Canfield's sick leave. The details of three rangers to assist in the reconnaissance constituted a most important factor in completing the surbey. Galt from the Lincoln, Wang from the Carson, and Smith from the Datil, all put forth highly satisfactory efforts, and besides securing reconnaissance experience, speeded up the work so that results will be available much sooner than if the Jornada staff had worked alone. Moreover, the interchange of ideas between the rangers and the local men brought about for everyone concerned a better and broader appreciation of the scope of work carried on by the Forest Service.

From the results obtained during the past field season, it is clear that administrative details are a marked success, and the opportunity is taken here to urge that details to the experiment stations be put definitely on a project basis. It is also suggested that details be considered similar to those sponsored at the Great Basin Experiment Station, where emphasis is placed on securing men of promise with considerable experience or technical grazing training. With the exception of Ranger Thomas, the Jornada handled the expenses of the men this year, but hereafter, either the District or the Forest concerned would have to share the cost.

Public Relations Activities and Visitors

As usual, the Reserve was honored by several prominent scientific visitors this year. Chapline's brief inspection was devoted largely to a consideration of manuscripts which had accumulated, and to a field check of the reconnaissance, but his stay on the Jornada was considered far too short for the good of the work.

James T. Jardine, former Inspector of Grazing in the Service, was an interested visitor in the early summer,. His stay was of special importance to the Station staff, as he is co-author of the two Departmental Bulletins published from the Jornada.

Prof. Wm. G. McGinnies, grazing specialist at the University of Arizona, gave two days in collaboration with the staff, and made a number of helpful suggestions, particularly in regard to studies of plant succession.

W. W. Eggleston, poisonous plant specialist with the Bureau of Plant Industry, made a careful check of the Jornada species of Astragalus in the early summer.

Assistant District Foresters Jones and Kerr were the most prominent administrative visitors to the Reserve. Ranger Ware, of the Colorado N. F., came to the Reserve for a day, and was particularly interested in the plant collections. These visits of administrative men are always welcomed by the Station staff, as they result in a more careful analysis of the current experimental work, and produce a wholesome criticism from an administrative viewpoint.

The Datil Ranger Conference

The grazing section of the Datil Ranger Conference was held at the Station April 9 to 11, through the cooperation of the Datil forest officers and some of the stockmen from the region. The three days were spent in a thorough inspection and discussion of the Jornada projects; to the mutual benefit of the visitors and Station personnel. The written comments of the visiting officers have already been published, but the following lines by Assistant Supervisor Hendricks are worth continued attention:

"The value of conservative stocking is clearly shown on the Reserve, and the contrast between range on the Reserve and the Public Domain shows plainly the difference between controlled and uncontrolled grazing. This one principle of conservative use of the range, if gotten across to the stockmen of the state, would mean an enormous saving in our basic forage resources."

Field Day Plans

With the satisfactory results of the Datil meeting in mind, it is sincerely recommended that another ranger conference for forests near the Reserve be planned for 1930, either before or after the fire season.

An excellent opportunity is offered the Station staff for contact with range men in November, 1929, during the regional Extension Service conference at the State College. It is planned to hold a one day session of the conference at the Reserve, for a brief presentation of the Jornada work.

Staff Visits

Campbell's visit to the Ruidoso District of the Lincoln was indeed time well spent, and it is hoped that similar details will be provided in the future. The principal feature of the trip was the addition of over 90 specimens to the Ranger Station herbarium, but it is not known how many of these plants are new to the Forest, as the returns have not yet been received.

American Forest Week Activities

Ranger Messer arranged for Campbell to address the livestock association of the Gallinas District on the Lincoln during American Forest Week, in connection with a program of foreatry and range management moving pictures. This opportunity forwarded a better appreciation of range research in the locality, and is considered a desirable activity for consideration in future plans at the Station.

The local efforts of the Jornada men during Forest Week resulted in the presentation of seven talks to organizations, one radio talk, and the publication of ten articles and editorials in local papers. Although the Reserve boasts of no yellow pine forests, in view of the number of people reached last year, it is planned to continue the American Forest Week activities this winter.

Cooperation

Range Improvements in accordance with the cooperative agreement.

Improvements completed December 2, 1928.

All fences except the mountain pasture.

Storage tanks and tubs at Stuart, South, Headquarters, West and Red Lake Wells, and drinking tubs at Middle Well.

Domestic supply tank and corrals at Headquarters.

Improvements not completed December 2, 1928.

North and south boundary fences, Pasture 11, and Pastures 1 - 11 division fence.

Storage tanks and tubs at Goldenburg, and rebuilding pipe line. Rebuilding the telephone line and installation of cattle guards and iron gates.

Status of Cooperative Agreement

The cooperator has given bond for faithful performance of the contract, and under the amended agreement he has until June 2, 1929 for finishing the incomplete items of the original two year period. As before, he has until December 2, 1930 for completion of the five year items; New Well and Taylor Well storage tanks and drinking tubs.

Restocking

The Reserve carried a breeding herd of 700 cows during the greater part of 1928, but in November and December, 1000 cows with calves were added to the herd. After selling 100 cull cows a breeding herd of 1600 remained; all that the records showed it safe to carry. The increased herd will result in a fuller use of

the Reserve pastures, and will put those projects depending on good utilization on a much more satisfactory basis.

Station Improvements and Equipment

No further road work was done this year largely because the county was not in a position to cooperate. A drag was constructed by the Station personnel for road maintenance, and the road signs furnished two years ago by the District Office were installed.

Owing to the pressure of investigative work this season, the improvements contemplated last year for the office building and dwelling house were not fully accomplished, although a small store room was added to the dwelling house.

In the way of equipment, the new "Model A" Ford was the most important acquisition. To insure some protection, three fire extinguishers were purchased, and installed in the various Government buildings. In order to relieve the demand for fire wood at the Station, purchases of equipment were made to effect the change from wood to gasoline for cooking and heating purposes, although the hot water tanks in both buildings are still dependent for their operation upon wood or coal burning stoves.

Needs

The greatest need at the Station in the equipment line is a calculator, a standard time saving device which requires no long winded discussion where there is as much computing to be done as at the Jornada.

The following needs are urgent, listed in order of their priority: an accurate set of balances, a rebuilt or new pantograph, a fire-proof safe, complete meteorological and weather recording equipment, apparatus for soil moisture determinations, survey and level instruments, and an electric light unit. With a probable expansion of work in the next few years, the Station will stand badly in need of a new office building with full laboratory equipment.

Maintenance work for the coming year should include replastering of the office building and dwelling house, and the painting of all government buildings, as little work of this character has been done for two years.

Finance and Allotments

The following funds, excluding the Welch Act increases, were provided for the Fiscal Year 1929.

Salary, Acting Director	$2400.00
Salary, Assistant	1920.00
Temporary Assistant	500.00
Stenographic and Clerical	200.00
Travel and general expenses	1200.00
New Truck	550.00
Total	$6770.00

Excluding the new truck allotment, which is non-recurring, the 1929 funds amount to $840.00 less than the R.I. allotments for the Fiscal Year 1928. This difference was caused largely by the director's transfer. With Campbell on 5 months scholastic leave this year, the new reconnaissance was made possible, and no deficit is anticipated, although there are many Station needs always on the waiting list.

The Jornada personnel wish to express again an appreciation of the handling of the Station finances by the District Office.

Estimated Expenditures Fiscal Year 1930

In order to provide for the Station needs, it is recommended that the following estimates for the Fiscal Year 1930, be favorably considered:

	R.I.	Imp.
Salary, Acting Director	$2600.00	
Salary, Assistant	2200.00	
Temporary Assistant	700.00	
Part time stenographer	600.00	
Temporary labor	200.00	
Travel and Station expenses	1400.00	
Station improvement		500.00
Totals	$7700.00	$500.00

Investigative Results

Influence of Climatic and Forage Conditions 1928

The precipitation on the Reserve was quite intermittent this year, with ample rainfall in May, then from July 19 through August, and finally during the entire autumn period. There was little precipitation previous to May, none during June or the first half of July, and little in September, just when moisture was needed to mature the summer forage crop. The fall rains helped mature the forage, however, and assured winter-spring weeds.

The important fact of the year's rainfall is that the seasonal precipitation was somewhat below average, which in the light of Nelson's findings means only one thing, i.e.: reduced density next year. With the probability of less feed next year, conservative stocking is essential to avoid overgrazing with all of its attendant losses. On this basis, the Jornada is being restocked this year with an estimated feed reserve of 25%, which margin is necessary to insure maintenance of range productivity.

The Application of Natural Revegetation Results

The purpose of the natural revegetation project is to develop a system of grazing, based on the growth requirements of the principal forage species, also to build up and maintain the range through natural reseeding and other methods of revegetation. The main results of the project to 1919 have been summarized in Departmental Bulletins 588, 745, and 1031. Former Director E. W. Nelson's new report "Management of Black Grama Range," which supplements earlier results, is due for submission in completed form to the board of review this winter.

One of Nelson's most important conclusions is that the greatest effect of the current year's rainfall is reflected in the following year's density. In other words, below average rainfall with overgrazing in one season mean a loss in density the next year.

Another conclusion reached by both Nelson and Schoeller in separate analyses of the same data is that proper grazing is more effective in maintaining a good stand of forage, particularly in an area subject to drought. All of these results point toward conservative grazing, with proper utilization as the most important factor under the stockman's control.

Utilization is taken up more fully under the discussion of carrying capacity.

Plant Succession Studies

In studying the mesquite (Prosopis glandulosa) sand dunes at the Station, Campbell has observed a definite series of successional stages from the barren, wind eroded blow out stage clear through to grass lands. Certain areas of the sandhills have gone through all the stages during the past three years of favorable growth conditions and light grazing on the Reserve, and are now coming into a grama grass climax. The main problem is centered about the holding of the soil and prevention of erosion in the blowouts between mesquite dunes. During the first year, two types of plants developed which arrested the sand movement: first, the mat stage, consisting of several species of low spreading annuals, and second, the ruderal weed stage, composed of large herbaceous plants, such as Helianthus, Aster, and others. The second year a dense stand of snakeweed (Gutierrezia jimsea) developed, which successfully stopped the destructive wind erosion, starting the leveling of the dunes and deposition in the blowouts. The third year, a fine stand of Sporobolus spp. appeared and all that remained for complete

revegetation was the development of a grama climax, which is now taking place in one or two limited areas. This final step, however, offers a difficult problem, particularly where grama has been killed through continued overgrazing. It is well to note that each successive stage is of increasing forage value, which is the same result obtained by McGinnies in his Montana grazing studies.

Other Plant Succession Studies

The snakeweed study, in which the competition between black grama and Gutierrezia juncea is under observation, is confirming the results obtained in the mesquite sand hills. During the four years of study the snakeweed has steadily lost ground to the grama. This change has taken place under light grazing, and with the Reserve more fully stocked, the study will now enter a period of observation under proper utilization.

The new reconnaissance will cast considerable light on the vegetative changes since 1915. Although incomplete, the survey already shows many type variations, and it is expected that the final analysis from a successional viewpoint will show many important changes in type values.

The current studies of plant succession have made necessary a thorough taxonomic knowledge of the Jornada flora, and as a result, extensive

plant collections on the Reserve in the last two years have added 102 species new to the Jornada herbarium, of which number 45 species were new Forest Service records. The addition of so many plants to the Station herbarium has necessitated careful checks of the herbarium specimens and of the current plant lists, and has resulted in the adoption of scientific plant names for all the experimental work, as the use of common names for so many plants was entirely too confusing. Scientific names were used in the reconnaissance, and the rangers detailed to the work experienced little difficulty in learning the list of names needed in the survey.

Application of Natural Revegetation Results

The studies being conducted on the Jornada are intended to solve problems applicable to outside range, so that it may be restored and maintained after overgrazing. When the results obtained at the Station can be applied to the Public Domain, and that great range area can be built up in carrying capacity, then the grazing burden now carried by national forests can be relieved.

The results of the natural revegetation project point to the need for a closer study of climatic conditions, so that changes in grazing capacity may be predicted before they arrive. There is also needed a better understanding of utilization as well as a clear conception by all range men of the proper utilization of each local type.

Clipping Studies

Two clipping study projects are being carried for the purpose of determining by artificial methods the effect of different intensities of grazing. These experiments are performed with the two main forage grasses, Bouteloua eriopoda and Hilaria mutica.

Close to moderate grazing of these grasses is simmulated by clipping by hand eight quadrats for each species at perscribed heights and intervals of time throughout the grazing season.

The black grama (B. eriopoda) clipping study was established in 1924. At this time a series of four one meter quadrats was designated to be clipped at a height of two inches above ground with a clipping interval of two weeks, four weeks, six weeks and the end of the growing season for the individual quadrat. In 1925 an additional series of four quadrats was established to be clipped at a height of one inch above ground with the same clipping intervals as the first series.

Each quadrat is clipped according to schedule and the harvest weighed when it is completely air dry. At the end of each growing season each quadrat is charted with a pantograph and the tuft area computed.

The net gain or loss of tuft area for the period of the experiment is more significant of the trend of the experiment than the data for individual years. The stimmilating effect of the clipping during the first two seasons is apt to be misinterpreted if single years are considered. In summing up the net gain or loss for the five year period for the first series--quadrat No. 1 clipped at the height of two inches at two week intervals shows the greatest loss (-28.4%) for the individual quadrat within the series. Quadrat No. 2 clipped at the height of two inches at four week intervals shows a loss of -13 % for the period. Quadrat No. 3 clipped at a height of two inches at six week intervals shows a net gain in tuft area of 43.5 %. Quadrat No. 4 clipped at a height of two inches at the end of the growing season shows a net gain of 38.0 %.

In the second series of four quadrats, "A" series, the clipping intervals are the same as in the first series but the height of clipping is one inch above the ground. These quadrats show a loss of tuft area throughout the series. ~~All quadrats show a loss of tuft area.~~ As the reaction to the one inch clipping height is somewhat eratic with quadrat No. 4-A which is clipped at the end of the

growing season shows a greater percent of loss than quadrat No. 1-A which is clipped at intervals throughout the growing season. The same is true of the quadrats clipped at four and six week intervals. The reaction of this series indicated that the one inch height of clipping over-utilizes the plants to such an extent as to almost completely overcome the normal reaction to time interval between clippings.

The total weight of harvest in grams for the four years shows the effect of clipping intervals on the production of forage. In the first series quadrat No. 1 over a period of four years produces less than 50 % as much forage per square decimeter as quadrat No. 4. Both quadrats are clipped at a height of two inches. No. 1 is clipped every two weeks while No. 2 is clipped once annually, at the end of the growing season. The same trend is evident in the second series (A series) which is clipped to a height of one inch. The clipping for the A series covers a period of three years therefore no direct comparison of the amount of forage produced can be made between the first series which has been clipped four seasons and the "A" series which has been clipped for three seasons.

The production of flower stalks per square decimeter show an increase directly proportionate to the clipping interval. The effect

of clipping is to stimulate the production of ~~four~~ flower stalks and the more often the plant is harvested the greater the number of flower stalks produced.

The precipitation records are taken for the period of growth. Readings are made weekly for the precipitation station located within the study enclosure. No attempt has been made to correlate the precipitation and the tuft area of the quadrats further than to note that all quadrats show a great increase in tuft area during the year of 1926 which had a total rainfall of 11.95 inches during the period of growth. The years of 1925, 1927 and 1928 show a much lower precipitation figure and a loss in tuft area is found throughout both series. The effect of rainfall is reflected in the volume production of forage. In this instance the year of 1926 shows the high mark in productivity for all quadrats. The length of growing season is controlled by the amount and distribution of the rainfall. 1926 had almost twice the number of days in the growing season as 1925 which has the next highest precipitation figure and longest period of growth.

A tabulated summary of the results to date are included on the following page of this report.

BLACK GRAMA CLIPPING STUDY --- SUMMARY OF DATA

Year	Quadrat No.	1	2	3	4	1A	2A	3A	4A
	Clipping Intervals	2 wks	4 wks	6 wks	end of seas.	2 wks	4 wks	6 wks	end of seas.
	Height of Clipping-inches	2"	2"	2"	2"	1"	1"	1"	1"
1924	Tutt Area--Sq. Dcms.	15.40	13.15	10.75	9.41				
1925	" " " "	15.32	12.10	10.38	8.35	13.24	12.55	9.60	10.08
1926	" " " "	24.51	22.63	20.49	17.66	16.98	14.94	13.91	8.01
1927	" " " "	22.76	21.53	17.92	16.24	13.33	11.03	9.51	5.95
1928	" " " "	11.03	11.44	15.43	12.99	7.56	6.58	6.01	4.91
1925	Gain or Loss % Tutt. Area	-0.5	-8.0	-3.4	-11.3				
1926	" " " " " "	60.0	87.0	97.4	106.5	28.2	19.0	44.9	20.5
1927	" " " " " "	-7.1	-4.9	-11.6	-8.0	-21.5	-26.2	-23.1	-25.7
1928	" " " " " "	-51.5	-46.8	-13.9	-20.0	-43.2	-40.3	-37.3	-17.5
	Net Gain or Loss % of Tutt. Area over 4&5 Yr. Period.	-28.4	-13.0	43.5	38.0	-42.8	-47.6	-37.4	-51.3 -Loss
1925	Total Gms. Dry Wt. Clipped.	45.8	51.0	51.0	68.3				
1926	" " " " "	70.0	61.9	103.9	98.9	78.7	80.2	76.4	63.1
1927	" " " " "	23.6	23.9	23.2	37.6	22.2	26.8	16.8	23.1
1928	" " " " "	2.0	0.5	1.9	1.1	0.2	0.6	2.2	1.0
1925	Gms. Dry Wt. per Sq. Dcm.	2.99	4.21	4.91	8.18				
1926	" " " " " "	2.82	2.74	5.07	5.61	4.63	5.37	5.49	7.82
1927	" " " " " "	1.04	1.11	1.29	2.32	1.67	2.43	1.75	3.89
1928	" " " " " "	0.18	0.04	0.12	0.08	0.03	0.09	0.37	0.20
	Total Harvest per Sq.Dcm.fr: Period.	7.03	8.10	11.39	16.19	6.33	7.89	7.61	11.91
1925	Growth began July 21 --- Ended Oct. 17. Period of Growth 88 days. Precipitation								7.01 inches
1926	" " May 18 --- " Nov. 9 " " " 175 " "								11.95 "
1927	" " July 25 --- " Oct. 1 " " " 69 " "								5.58 "
1928	" " July 20 --- " Oct. 5 " " " 77 " "								3.75 "

Tobosa Clipping Study

The Tobosa grass (Hilaria mutica) clipping study was established in the field in 1924. At this time eight one meter quadrats were located and marked with permanent stakes.

Like the Black grama study the quadrats were divided into two series on the basis of height of clipping. The plain series were clipped to a height of two inches at regular intervals and the "A" series were clipped to a height of four inches at the same intervals of time for quadrats with corresponding numerals. The behavior of these quadrats has been rather erratic to date. However, a period of drought should bring out some significant facts that will be of value.

At present the clipping seems to be stimulating growth in these quadrats. The quadrats clipped to four inches appear not to yield to the influence of the clipping interval to the extent that the quadrats clipped to two inches do.

One of the reasons to which the slowness of response on the part of this clipping study is attributed to the fact that tobosa grass is a turf grass while black grama is a bunch grass. A summary of the data is included on the following page of this report.

TOBOSA CLIPPING STUDY --- SUMMARY OF DATA. 1928

Year	Quadrat No.	1	2	3	4	1A	2A	3A	4A	5	
	Clipping Intervals	1 wk	2 wks	4 wks	end of seas	1 wk	2 wks	4 wks	end of seas	Control	
	Height of Clipping	2"	2"	2"	2"	4"	4"	4"	4"	Control	not clipped
1924	Tuft area--Sq. Dcms.	7.47	8.14	9.10	12.26	7.01	9.51	9.24	12.85		
1925	" " " "	16.97	14.34	11.80	11.61	17.76	13.26	12.42	11.61		
1926	" " " "	35.92	31.58	31.56	27.02	32.99	29.53	31.66	29.35	26.95	
1927	" " " "	29.24	30.04	26.37	25.17	30.34	31.47	37.52	35.02	29.76	
1928	" " " "	28.50	30.81	29.81	32.04	37.40	25.77	26.65	22.18	19.22	
1925	Gain or Loss % Tuft Area	127.2	82.3	29.7	-5.5	150.1	39.4	34.4	-9.6		-Loss
1926	" " " "	111.5	112.8	167.4	132.7	85.7	122.7	154.9	152.8		
1927	" " " "	-16.5	-4.9	-18.1	-5.8	6.4	6.2	18.2	19.3	10.4	
1928	" " " "	-4.8	2.6	11.5	27.2	-2.5	18.1	-28.9	-36.7	-35.4	
	Net gain or Loss 4 end 4 years	67.9	107.6	152.6	176.0	110.6	94.3	114.5	91.0	-28.7	
1925	Total Gms. Dry Wt. per Quadrat	113.7	179.5	160.2	271.9	117.1	87.2	110.8	187.0		
1926	" " " " " "	117.8	97.9	101.5	130.7	35.8	53.2	88.4	74.7		
1927	" " " " " "	79.1	90.1	90.3	195.2	97.3	74.9	72.9	103.9		
1928	" " " " " "	5.7	14.3	2.9	0.8	6.7	4.9	3.4	2.0		Poor Growth
1925	Gms. Dry Wt. per Sq. Dcm.	6.70	8.73	13.58	23.42	6.59	6.53	8.92	15.42		Based on
1926	" " " " " "	3.28	3.10	3.21	6.69	2.60	1.80	1.84	2.55		actual tutt.
1927	" " " " " "	2.64	2.99	3.42	7.76	2.54	2.38	1.94	2.97		area.
1928	" " " " " "	0.20	0.14	0.10	0.03	0.16	0.19	0.13	0.09		
	Total 4 Year Period	12.82	14.96	33.30	37.90	11.91	10.95	12.73	21.03		

1925	Growth began July 21	Ended Oct. 17	Period of growth	88 days	Precipitation	7.01 inches			
1926	" " May 18	" Nov. 9	" " "	175 "	"	12.41 "			
1927	" " July 25	" Oct. 1	" " "	69 "	"	7.57 "			
1928	" " July 20	" Oct. 5	" " "	77 "	"	4.34 "			

Carrying Capacity of Southwestern Ranges

The number of stock that a range will safely carry is based on the forage requirements of the animal and that portion of the annual value production of palatable plants which may be removed by grazing animals during the year without detriment to the range.

Studies to determine the carrying capacity of Southwestern ranges have been in progress on the Jornada since 1915. From these studies has developed the fact that the only sound basis of stocking is one that will assure the range carrying a sustained number of stock through a series of years and at the same time maintain the range in a high state of forage production.

In determining the carrying capacity of a range in this region it is necessary to consider the adverse climatic conditions under which the vegetation is produced. We have good years and bad years, depending on the amount of rainfall during the period of growth. In 1925 the period of growth was 88 days with 7.01 inches of precipitation. 1926 had 175 days in the growing season and the precipitation for that period was 13.19 inches. 1927 had a growing season of 69 days and the precipitation was 6.79 inches for that period. 1928 had a growing season 77 days in length and a rainfall for the

period of 4.36 inches.

Since the seasonal rainfall appears to be the controlling factor of plant growth in this region because of the wide variation between years it is impractical to stock close to the estimated carrying capacity of a range for good years. In a so called normal or average year with its 4.70 inches of precipitation during the period of growth the forage should not be utilized to more than 75 % of so called proper use.

This policy of leaving an additional 25 % of the forage untouched at the beginning of the new growing season produces reserve feed that acts as a factor of safety which goes a long way in the prevention of serious over utilization during dry years.

This factor of safety is believed to be sufficient although the production of forage between good years and years of drought is known to vary as much as 60 %. Quadrats charted annually in connection with the Natural Revegetation project often show an increase in tuft area of over 100 % in the second or third year subsequent to the breaking of a drought.

According to the following figures quoted from Schoeller's Mss. range stocked to the carrying capacity of the good years is eventually an overstocked range.

Carrying capacity studies conducted on the Jornada during a four year period of drought show the fluctuation in number of surface acres required per head year long to be as follows:

Summer-fall range from 77.3 to 158.9 surface acres.

Winter-spring range from 81.4 to 196.4 surface acres.

Mixed type yearlong range from 84.2 to 148.5 surface acres.

The change in carrying capacity of the range as indicated by the above figures was due to a loss in density of the main forage species and to a variation in the volume of the general forage crop. This variation was due in part to over-stocking and in part to drought.

Usually the greatest damage from over-stocking takes place during the spring months just prior to the growing season during years of drought as well as in years of good rainfall. In the spring there is usually a period of high winds which work considerable detriment by erosion on areas that are not protected by vegetation.

The application of a conservative stocking policy on the Jornada over a period of thirteen years has resulted in maintaining the range

in an unimpaired state of forage productivity. During these years two periods of drought have occurred and eight of the years had a below average seasonal rainfall. Most of the nearby outside ranges are badly depleted by overgrazing. There is no reason to believe that the outside range is not potentially equal to the Jornada in every way.

Overutilization during periods of drought no doubt work a greater detrement to the range than the same degree of overgrazing does in years of average precipitation. A little over-utilization at this time when the resistence of the plants is lowered by adverse climatic conditions is often the final strain which breaks the camels back.

Ranges stocked to their maximum carrying capacity in 1926 were able to support the stock through 1927 by the aid of a relatively small amount of supplemental feeding. In 1928 with no appreciable rainfall during the spring and early summer losses were heavy in spite of supplemental feeding. One rancher reports the loss of over a hundred head of calves during the summer. Another stockman reports the loss of fifty or more calves. Both attribute their losses to intense heat. In neither case was disease suspected as the cause.

During the same period two calves died on the Jornada, one from bogging down in a surface tank, the other from injuries received in branding. In view of the fact that the summer temperatures on the Jornada were very likely just as high as the temperatures on the other ranges of this locality it seems rather far fetched to account for the loss in this manner.

The real facts of the case are that both these men admit the shortage of forage on their ranges during the period of loss. At the same time there was a plentiful supply of forage on the Jornada. The difference in forage supply seems to be the logical reason for the difference in numbers of calves lost on the respective ranges.

In estimating the carrying capacity of a range only the available forage should be considered. Range which is far from water or is not used by stock for any other reason should not be included in the estimate.

The spring weed crop should be regarded as an additional factor of safety and not as forage upon which the carrying capacity of a range can be based. The production of spring weeds in any appreciable amount occurs only about once in a decade.

The seasonal palatibility of the forage is also a big factor in carrying capacity. In the instance of a tobosa grass range the summer palatability is about .60. The winter palatability is not over .10. Annuals usually have a short seasonal palatability while many perennial plants are palatable year long.

The method now used in making the carrying capacity estimates on the Jornada is to make a complete utilization map of the pastures each year. This estimate is checked against the actual use and the estimated forage crop for the year which gives a carrying capacity figure which is a very good basis for the stocking of the Reserve. As soon as the present reconnaissance is completed the carrying capacity will be placed on a forage acre basis.

Two previous reconnaissances of the Jornada have been made. One of them was made during the peak of forage production, the other during a period of drought. The third reconnaissance, which is now under way, is also made at a peak of forage production. It is believed that a study of the data from the three separate reconnaissances, together with the records of actual use of the range, will give the best possible data on forage acre requirement of stock for this region.

All the Jornada studies on carrying capacity point to one fundamental fact--conservative stocking.

The decreased number of stock necessary to the practice of conservative stocking does not mean a reduction of profits. It points the way to a stabilized livestock industry with a sustained yield from smaller, well fed, high grade, prolific herds which produce a high percent calf crop and have a low percent death loss.

In support of the preceding conclusions an eleven year average of the Jornada calf crop is 47.8 % greater and the death loss for the same period is approximately one third as large as the estimated figures for herds on similar outside ranges.

Some Outstanding Results of the Handling Stock Projects

Handling Stock on the Southwestern Ranges involves a number of projects which have been carried as experiments on the Jornada Range Reserve over a period of thirteen years.

The purpose of these experiments is to develop a method of handling stock which is consistent with good range management and at the same time increases the profits of the owner.

The Jornada breeding herd is made up of high grade Hereford cows and purebred Hereford bulls. With a plentiful supply of forage the quality of the offspring from this herd is such as to top the market for this region.

The breeding season is regulated somewhat by the growing season. Usually there is a good supply of green forage early in June at which time the bulls are distributed among the cows. As nearly as is possible a sex ratio of one bull to twenty cows is maintained. At the end of the breeding season, which is approximately six months long, the bulls are segregated in pasture No. 9. The calves are weaned at eight months of age. So far very little weaning has been necessary because the calves have been shipped at about the right age for weaning.

As a general policy the quality of the Jornada herd is maintained by a systematic removal and sale of all old bulls and old or barren cows. These culls are replaced with young purebred bulls obtained by purchase and selected heifer calves from the Jornada herd.

In so far as blood is concerned an inspection of the herds on adjacent ranges will show that the Jornada herd does not far excell in breeding the average range stock of this locality. This fact justifies the conclusion that in the event that the profits from the Jornada herd are greater than the average for the region, the difference is due to the methods of handling stock and the management of the range.

The profits from the Jornada herd have been increased in three ways; by reducing the death loss, by increasing the percent of the calf crop, and by maintaining a thrifty, well fed condition of the herd throughout the year.

The improvement in grade of stock has been pretty generally sold to the stockmen by the various Federal and State bureaus and other agencies. The next step is to sell them range management with conservative stocking as a means of improving the quality of their product and as the means of eliminating preventable loss.

In order to apply conservative stocking it is necessary to have a fair knowledge of the character of the range. The Jornada is a very good representative area of the range in the semi-desert region of the Southwest. In developing an economical method of handling stock on this area it has been found to be necessary to divide the range into two general types on the basis of proper seasonal use.

The first of the two types to be considered is the summer-fall type of range in which the most important forage plants maintain their highest palatability during the growing season. The second general type is the winter-spring type of range, so named because the main forage plants in this type maintain their palatability throughout the winter months as well as during the growing season.

As far as is consistent with practical range management the seasonal use on the Jornada is controlled by fencing. However, fencing is an expensive operation and is not generally practical except where large areas are involved.

On the Jornada controll of the stock on the basis of seasonal use by fencing has proved to be the most economical method in Pastures Number Six, Eight, Nine, Ten and Eleven. Pastures No. Six and Eight are summer-fall type range. The breeding herd is congregated in these two pastures during the first

two or three months of the breeding season. Pasture No. Nine is winter-spring type range in which the predominating forage species is Black grama (B. eriopode) This area is used exclusively as a bull pasture. Pasture No. Ten is winter-spring range. The predominating forage species here is also Black grama. Pasture No. Eleven is a mountanous area which is not being used at the present time. This pasture will furnish reserve forage year long in the event of drought.

Pastures No. One and No. Two are a mixture of summer-fall and winter-spring type range. They are termed year long pastures. Fencing as a method of control in these pastures is unpractical because of the intermingling of the two types.

Distribution of stock according to proper seasonal use is maintained and regulated in the year long pastures by the location of and the control of the watering places. The watering places are so located that stock will not of necessity have to travel more than three miles to water.

There are two kinds of water storage in use on the Jornada--the dirt reservoir and the steel storage tank. The water furnished by dirt reservoirs is controlled by locating the reservoir within an area of summer-fall forage. In this instance the water is furnished by surface run off from rains which

occur during the growing season. Therefore, water furnished by dirt reservoirs is generally most abundant during the period of highest palatability of the summer-fall type range.

In addition to temporary water supplied by surface reservoirs the winter-spring type of range is watered by a permanent supply from wells from which the water is pumped by wind power and stored in steel tanks. In Pasture No. One the wells will by supplemented by a pipe line which furnished permanent water to the central part of the pasture. By the opening or closing of the valves at the steel storage tanks or pipe line the supply of permanent water in any portion of the pastures is controlled at will.

Since the water supply plays such a large part in handling stock and range management in the Southwest the methods used in supplying water to the range is an important phase of the projects.

Until recently the water storage on the Jornada was accomplished by the construction of dirt reservoirs at all wells. These dirt reservoirs are being replaced as rapidly as possible with steel storage tanks. To date five wells are equipped with new steel tanks. When properly constructed steel tanks are more dependable than dirt reservoirs. The

probibility of steel tanks being destroyed by burrowing rodents or heavy rains is remote. The danger of the destruction of dirt reservoirs from these two causes alone is always imminent.

The relative cost of construction and maintenance of dirt reservoirs and steel storage tanks has not been determined. However, two 65,000 gallon steel storage tanks were constructed in 1927 at a cost of $396.95 and $569.81 respectively. The maintainance cost of these tanks has not amounted to one cent to date, nor is there any indications that any maintainance will be necessary for many years to come. When the cost of cleaning dirt reservoirs of silt or the construction of new ones every few years is considered the steel tank appears to be the most economical method of water storage for ranges of the Jornada character. A supply of permanent water, well distributed when and where it is needed, is an essential feature in the conservative use of the range.

All the experiments carried on the Jornada relative to handling stock show conclusively that conservative stocking is the key to successful stock raising.

The range is the basis of the live-stock industry of this region. A productive range is built up and maintained in a high state of product-ivity by conservative use. A plentiful supply of

native forage is the best business insurance the stockman can obtain.

In support of conservative use of the range the Jornada calf crop over a period of twelve years averages 21.2 % higher than the calf crop for similar outside ranges for the same period. The quality of the Jornada calves is not excelled in this region.

Conservative stocking also lengthens the productive life of the breeding herd and reduces the death loss of mature and young stock as well as enhancing the value of the calf product.

In support of conservative stocking a comparison of the Jornada calf crop and loss data with the figures taken from outside ranges leaves no room for doubt of the value of the methods used on the Jornada.

Figures covering a period of eleven years show the average Jornada calf crop to be 67.9 %. The average calf crop on the outside range for the same period is 46.1 %. The average death loss on the Jornada for the eleven year period is 2 %. The estimated average death loss on similar uncontrolled ranges of this region is 6 %.

Results of Overstocking the Range

The animal and vegetable life of the range is governed by certain inflexible natural laws. Should these laws be broken, the penalties are inevitable. One of the most common transgressions of nature's laws in range mismanagement is that of overstocking. In this instance, the penalties are visited upon both the range and the livestock. The owner ultimately pays the bill since a great many of the detrimental effects of overstocking result in a material reduction or the elimination of the owner's profits.

Loss is in direct opposition to profit. If the whole of the loss due to overstocking of the range could be accounted for by the sum of the emaciated carcasses rotting on the range and the extra time expended in "tailing up" the weak animals, the situation would not be so grave. However, this is not the case. A far greater loss which cannot be visibly summed up is incurred in the following ways:

Poor, underfed, unattractive animals command a lower price than well-fed stock of the same class.

The productive life of the breeding herd is shortened by starvation.

The productivity of the herd is lowered. A small calf crop is nature's first step toward the restoration of a biological balance between the plant

and animal life on the range.

The quality of the product is lowered by the under-development of the calves. Low quality means low prices.

The high death loss from disease. Weak, starved animals are less disease-resistant than sturdy, well-fed stock.

The excessive death loss from starvation during periods of drought. This loss may run as high as 30 percent of the breeding herd.

The costly supplemental feeding of concentrates or the shipping of cattle to distant ranges during years of low forage production.

The sacrifice of animals by forced sale under adverse market conditions in the event of drought.

The devastating effect of overstocking on the range itself. The value of a range is based, primarily, upon the number of stock which it will consistently support. Overstocking results in overutilization of the forage. Overutilization leads on to overgrazing. An overgrazed range is materially reduced in volume and in extreme cases may be practically worthless because it will not support a sufficient number of stock to be profitable.

All of the foregoing sources of loss have been materially reduced or eliminated on the Jornada Range Reserve by the application of conservative stock-

ing and other fundamental practices of good range management.

Losses must be subtracted from the profits until the profits are exhausted. Reduce the losses and the profits automatically increase.

The Purchase of Cows With Calves in Drought Stricken Areas

The Jornada Cooperator has adapted the policy of replacing the numbers culled from the herd by purchasing cows with calves out side at a reasonable figure in drought stricken areas. During 1927 and 1928 he was able to purchase these cows and calves at a figure which was approximately the same as the price received for the cull cows. The calves were marketed with the Jornada calves at the same price per head.

By carrying forward the water development plan for the Jornada according to the specifications of the Cooperative agreement the maximum average carrying capacity of the Reserve is made available this year. In accordance with the additional development of forage resources about a thousand head of cows with calves were purchased at a cost of about two and one half dollars more per cow and calf than was received per head for the cull cows this year.

The practice of buying cows with calves in drought stricken areas is believed to be a sound business policy. However, in order to carry out a deal of this nature successfully, it is necessary to have a plentiful supply of forage.

Plans for the Future

Natural Revegetation

The new report on the natural revegetation project, "Management of Black Grama Range," by E. W. Nelson, was revised in Washington last winter and now includes the 1927 data. The manuscript went the rounds for preliminary comment during the summer, and Nelson is expected to submit it in final form to the board of review this winter.

The present quadrat basis retains the old system of plots at varying distances from water, which gives results on different intensities of utilization, including data on overgrazing versus conservative use. In addition, several new series of quadrats have been established to permit closer study of individual types, and enough rain gages have been located over the Reserve to show definite relationships between precipitation and specific vegetative changes.

With the present organization of the investigations, a most pressing need is for an adequate knowledge of all the climatic factors, with full records at the Station Headquarters. Some evaporation data from Livingston atmometers have been obtained during the past two years, and an expansion of this work is highly desirable. Soil moisture data in particular is badly needed in connection with the natural

revegetation project, because soil moisture is one of the most important factors in plant development, especially in a semi-desert area.

The fact of the matter is that a more fundamental basis for the investigations is needed. There should be a close study of types on the Reserve other than grama. During the next two years, it is planned to make a thorough investigation of successional trends as shown by the fifteen years of quadrat records, from the reconnaisance data, and by ocular observations of type changes and the habits of individual species. A paper is to be prepared for submission to the Journal of Agricultural Research, which will cover all the Reserve types, written from the viewpoint of plant succession in its relation to natural revegetation, and showing the forage value of each stage in succession.

To give the results of competition between snakeweed and black grama under light grazing conditions, a project report covering the snakeweed study is planned for the coming year.

There are many factors affecting the management of range vegetation which have not been measured, and which can not be studied unless there is made available either more men or more time for the present staff. The efforts at the Station thus far have been

toward a better understanding of the main problems. The Station work is now in a status to permit elimination of the non-essentials, so that plans can be carried out for completing field work on time, which will greatly facilitate the prompt compilation and analysis of data.

The general policy of expansion at the Station must remain quite conservative, but it would help materially to have a third permanent worker desiring post graduate work, so that two men would be available each winter, and the Station staff would consist of a full three man team of young students, all seeking higher degrees.

Carrying Capacity

Little has been done this year on the carrying capacity report, but Chapline expects to spend a month this winter on additional analysis of the data, so that by next year the Departmental Bulletin "Grazing Capacity in the Southwest," by Chapline and Schoeller, should be nearing completion. The present work on the project is an attempt to tie in the quadrats to proper utilization, and the adjustments made necessary by variations in the type from year to year. With data available from three

reconnaissance surveys, carrying capacity on the Reserve will be put on a forage acre basis, and with such a mass of data at hand, further information on the forage acre, and forage acre requirements of cattle should be forthcoming.

The short paper "Conservative Stocking Pays," prepared last winter by Campbell and Canfield, is to be revised for submission to the "Cattleman."

Handling Stock

A revised article on the "Cost of a Range Calf" is planned for submission to the "Producer" next year. Campbell and Canfield also plan an article comparing the cost of steel versus dirt tanks, as used at the Station. This paper will also be submitted to the "Producer."

Publications

Published or submitted during 1928

1. "Management of Black Grama Range", To be published as a Departmental Bulletin, E. W. Nelson.
2. "An Improved Pair of Shears for Clipping Studies on Quadrats", Ecology, January, 1928. R. S. Campbell and R. H. Canfield.
3. "The Prosopis Sand Dunes of Southern New Mexico", R. S. Campbell.
4. "Solid Stems in Certain New Mexico Grasses", R. H. Canfield.
5. "Conservative Grazing Pays", R. S. Campbell and R. H. Canfield.
6. "A Case of Phyllody in Yucca elata", R. S. Campbell

To be submitted during 1929

1. "Grazing Capacity of Southwestern Ranges", W. R. Chapline and J. D. Schoeller.
2. "Competition between Snakeweed and Black Grama", Progress Report, R. S. Campbell.
3. "Steel Water Storage Tanks", Cost article, R. S. Campbell.
4. "Growth and Reproduction of Soapweed(Yucca elata)", R. S. Campbell.
5. "Notes on the New Mexico Road Runner", R. H. Canfield.

RG
Artificial Reseeding

December 15, 1928

Project: The introduction and propagation of drought resistent herbaceous and tree species.

Scope: To test various exotic and native plants of all classes, to find species capable of resisting the climatic conditions on the Jornada and similar range.

Status: The several species of exotic grasses and weeds tested have largely failed, due to the arid climate of this region. Results to date included in progress reports. No further plantings of exotic herbacious plants made this year.

Through the courtesy of Mr. Wales of the District office, seedlings of Kilanthus and osage orange were obtained. The results, which are fairly satisfactory, are shown below.

An attempt was made to propagate a number of native species around the Headquarters yard this year. Sclewpogon brevifolius, a grass; Verbena and Baileya, very attractive flowering plants, and Acacia and Floureusia, shrubs, all had higher percentages of survival and made very satisfactory growth during the season, with only a minimum of watering during the early summer.

Results: The growth results from the shrubs planted near the Headquarters in 1923 and during this year are shown in the following table.

Species	No. planted	No. living	% survival	Avg. Ht.	Avg. Ht. growth--1928
Chinese Pistache	53	2	3.8	12"	0
Chinese elm	175	6	3.4	261"	0
Ailanthus[22]	5	1	20.0	26"	22"
Osage orange[22]	5	5	100.0	18"	14"
Flourensia[22]			80	12"	8"
Acacia[22]	4	3	75	11"	8"

[2] Exclusive of one tree 184" high, grown over cess pool, and one tree 8" high, cut back this year.

[22] Planted in 1928.

n Estimated % survival.

Flourensia and Acacia are native species.

The Chinese elms were badly hit again this year by the dry spring, and by rabbits eating the lower bark, although wire guards were later built to protect the basal portion of each tree.

Further Work: No further work with exotic species is contemplated, but it is planned to continue the tests with native species, mostly in spare time.

Date of Completion: Continuous.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Natural Revegetation

December 15, 1928

Project: Natural revegetation of south central New Mexico range types.

Scope: To develop a system or systems of grazing based upon the growth requirements of the principal forage plants, which will build up range land similar to that of the Jornada Range Reserve, by natural reseeding and revegetation, and maintain such ranges at their highest degree of productivity.

Status: Results from 1915 to 1919 published in U.S.D.A. Bulletins 588 and 1031. A Departmental Bulletin on "Management of Black Grama Range," was prepared last winter by E.W. Nelson, former Director. This manuscript has gone the rounds for comment, and will go to the board of review this winter.

Three new series of quadrats and additional plots in three old series were established in 1927 in order to give more complete data on Prosopis--sandhill, Bouteloua-Covillea, Bouteloua, and Hilaria types of range. Out of two hundred quadrats established in connection with Natural Revegetation and related projects, one hundred thirty were charted this year. Of the remaining seventy quadrats, thirty five are either abandoned or carried as inactive, and thirty five are carried on an alternate year charting schedule. The data from 1915 to 1927 have been compiled and analyzed by Nelson for his bulletin, and the data to 1925 will be correlated with carrying capacity by Chapline this winter in Washington.

Important results from Nelson's analysis are found in the investigative results section of this report.

The excellent vegetative conditions on the Reserve continued during the year 1927, although the 1928 growing season fell a little below the mean seasonal rainfall (see accompanying maps.) On the Reserve, nearly all perennial vegetation held the density gained last year, although continuously overgrazed range outside the Reserve was in poor condition at the end of the growing season.

Livingston atmometers were run only at the Headquarters station during 1928. Results from the four stations run in 1927 were compiled and partially analyzed.

"The Mesquite Sanddunes of Southern New Mexico," by Campbell, was submitted for publication and for presentation at the 1928 New York meeting of the American Association for the Advancement of Science. This paper opens up the plant succession studies and is the first of a series upon intensive ecological problems on the Reserve, upon which the new reconnaissance is expected to throw considerable light.

Further Work: Project to be continued according to revised work plan. Data to be compiled and analyzed each year for progress reports, and for plant succession results. Evaporation activities to be continued on a small scale until adequate personnel becomes available to handle both evaporation and soil moisture investigations on a satisfactory basis.

Canfield's paper on "Solid Stems in Grasses" to be revised and submitted for publication. Canfield expects to go into the morphological and physiological aspects of his problem more deeply during his school leave in 1929-30.

Plant succession studies to be made of all the mesa types on the Reserve, and a report covering them to be written and submitted for publication in the Journal of Agricultural Research within the next two years.

Canfield's special investigations on the habits and reproduction of Boutelcua eriopoda to be continued and published, provided his time is available.

Date of Completion: Indefinite.

Assignment: Jornada Range Reserve
Campbell and Canfield.

MG
Climatic Data

December 26, 1928

Project: To keep a daily and monthly record of climatic conditions on the Jornada Range Reserve.

Scope: To determine the effect of climatic factors on the vegetation of the Southwestern ranges.

Status: Daily temperatures and precipitation records are kept for the Headquarters Station. Readings are made at 17 additional precipitation stations within the Reserve as often during the month as is compatible with other work. The 18 precipitation stations within the Reserve are supplemented by 4 outside stations located at the headquarters of neighboring ranches.

A monthly report covering the daily temperatures, prevailing winds and precipitation is made to the Weather Bureau office at Santa Fe.

Precipitation maps showing the approximate areas with regard to the amount of seasonal and annual rainfall are prepared annually.

Maps and tabulated data showing the local character of the rainfall in this region are included in the following pages of this report.

Campbell continued his work with Livingston atmometers throughout the past growing season. The results were very satisfactory and thoroughly demonstrate the high rate of water loss which plants undergo in this region.

Further Work: Project to be continued on present basis. Data to be compiled and and analyzed in connection with Natural Revegetation data. More intensive work on measurement of climatic factors to be made as soon as personnel and equipment becomes available.

Date of Completion: Indefinite.

Assignment: Jornada Range Experiment Station
Campbell and Canfield

LEGEND: SEASONAL RAINFALL JULY, AUG., SEPT., 1928

STATION	PRECIPITATION INCHES		APPROX. AREA COVERED
South Well	2.96	2 - 3	
Red Lake	3.45	3 - 4	
Enclosure # 1	3.62	" "	
Road Tank	3.64	" "	
West Well	3.68	" "	
Headquarters	3.71	" "	
Number 10	3.75	" "	
Aristida Encl.	4.12	4 - 5	
New Well	4.29	" "	
Brown Tank	4.31	" "	
Stuart Well	4.34	" "	
St. Nicholas	4.40	" "	
Sand Hills	4.61	" "	
Ragged Tank	4.71	" "	
Period Study	4.91	" "	
Number 2	5.28	5 - 6	
Middle Well	5.88	" "	
Ropes	6.77	6 - 7	

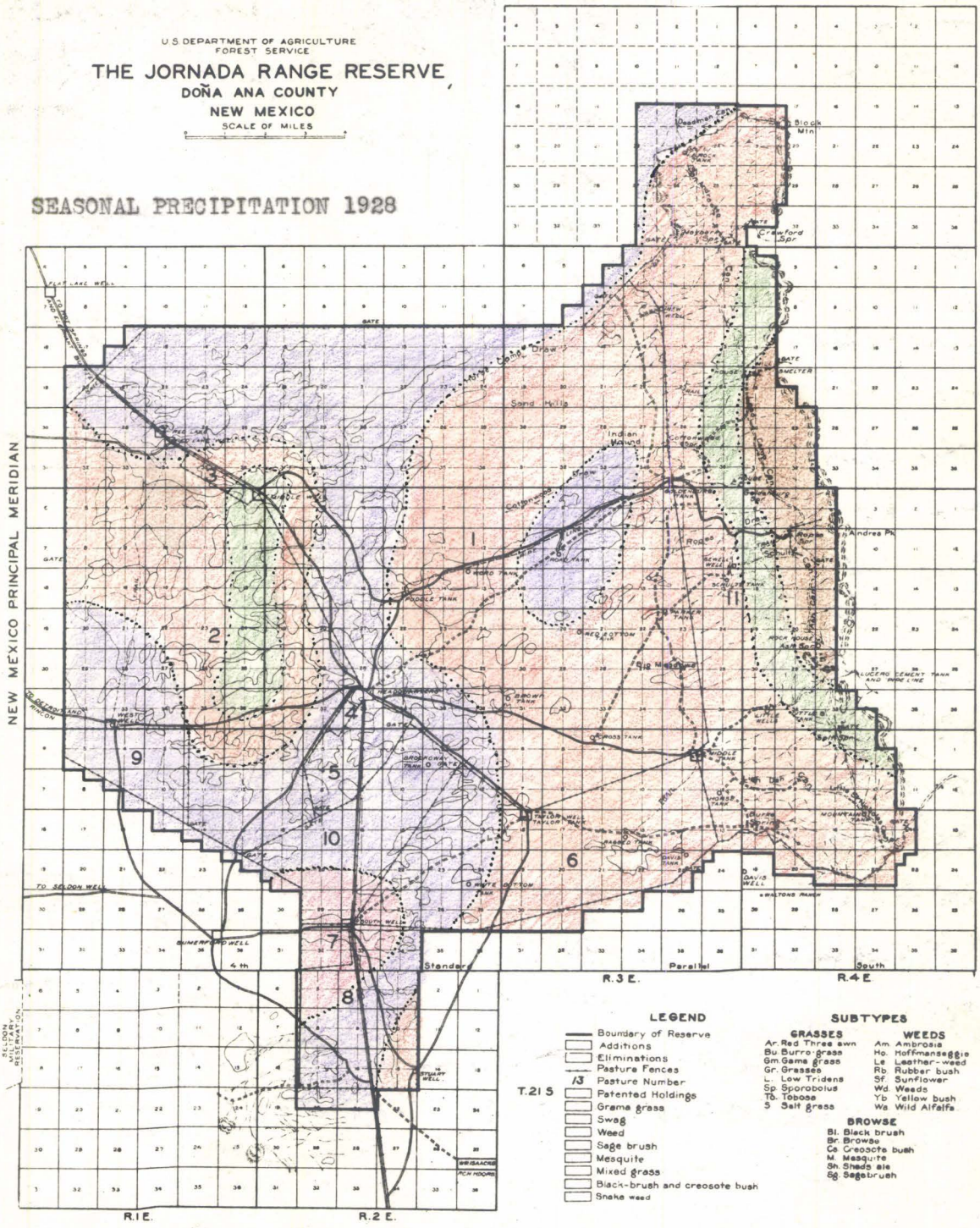
Note local character of the rain fall as shown by the variation in precipitation for the individual stations.

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

THE JORNADA RANGE RESERVE

DOÑA ANA COUNTY
NEW MEXICO
SCALE OF MILES

SEASONAL PRECIPITATION 1928



LEGEND:	ANNUAL RAINFALL		GRAZING YEAR 1928
STATION	PRECIPITATION	INCHES	APPROX. AREA COVERED
Middle Well	7.23	7 - 8	
Aristida Encl.	7.43	" "	
Enclosure # 10	8.07	8 - 9	
New Well	8.48	" "	
South Well	8.70	" "	
Headquarters	8.74	" "	
Enclosure # 1	8.92	" "	
Red Lake	9.21	9 - 10	
Ragged Tank	9.29	" "	
Period Study	9.30	" "	
Brown Tank	9.86	" "	
Road Tank	10.09	10 - 11	
Stuart Well	10.13	" "	
Enclosure # 2	10.17	" "	
West Well	10.68	" "	
Ropes	10.87	" "	
Sand Hills	11.50	11 - 12	
St. Nicholas	12.46	12 - 13	

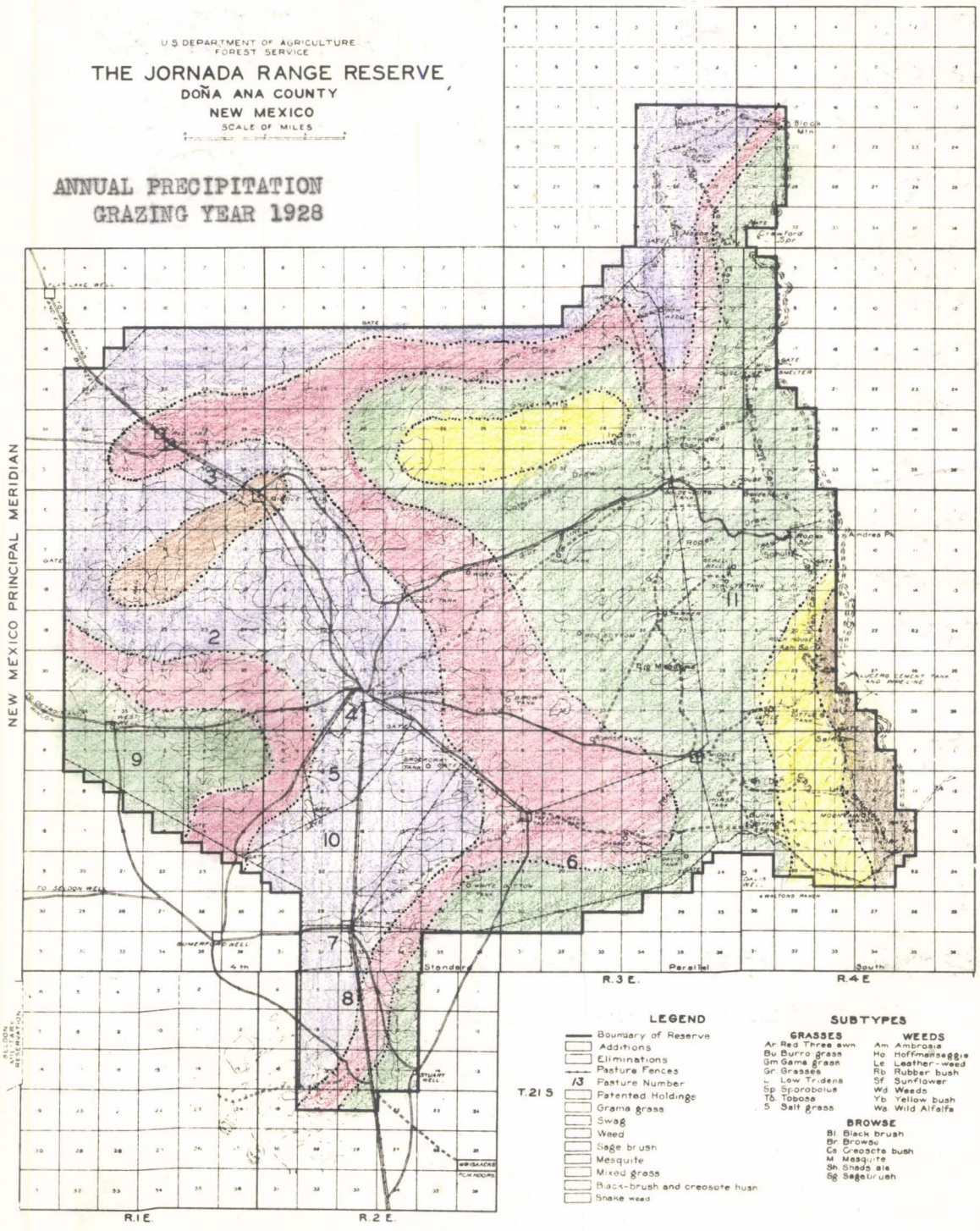
Grazing Year Corresponds to Fiscal Year 1928

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

THE JORNADA RANGE RESERVE

DOÑA ANA COUNTY
NEW MEXICO
SCALE OF MILES

ANNUAL PRECIPITATION
GRAZING YEAR 1928



PRECIPITATION—JORNADA RANGE RESERVE

GRAZING YEAR 1928 AND SEASONAL CALENDAR YEAR 1928

Station	Calendar Year 1927						Calendar Year 1928						Total Ann.	Seas. 1927	Seas. 1928
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June			
Aristida Encl.	1.30	1.45	2.23	0.00	0.00	0.42	0.00	0.84	0.00	0.09	1.18	T	7.43	4.98	4.12
Brown Tank	2.30	1.77	3.51	0.00	0.00	0.57	0.00	0.41	0.00	0.10	1.20	T	9.86	7.58	4.31
Headquarters	1.32	2.32	2.52	0.01	T	0.53	0.00	0.82	T	0.09	1.13	T	8.74	5.16	3.71
Middle Well	0.30	1.22	1.89	0.00	0.00	0.42	0.00	0.98	0.00	0.11	2.31	T	7.23	3.41	5.88
New Well	1.95	1.95	2.13	0.00	0.00	0.68	0.00	0.47	0.00	0.10	1.20	T	8.18	6.03	4.29
Period Study	1.71	2.52	2.55	0.00	0.00	0.51	0.00	0.82	0.00	0.09	1.10	T	9.30	6.78	4.91
Ragged Tank	2.00	2.79	1.98	0.00	0.00	0.55	0.00	0.63	0.00	0.09	1.25	T	9.29	6.77	4.71
Red Lake	0.87	2.84	2.52	0.00	0.00	0.48	0.00	0.41	0.00	0.11	1.98	T	9.21	5.23	3.45
Road Tank	1.87	2.61	2.97	0.00	0.00	0.55	0.00	0.69	0.00	0.10	1.30	T	10.09	7.45	3.64
Ropes	2.16	2.98	2.09	0.00	0.00	0.91	0.00	1.29	0.00	0.09	1.35	T	10.87	7.23	5.77
Sand Hills	3.98	1.79	3.11	0.00	0.00	0.46	0.00	0.81	0.00	0.10	1.25	T	11.50	8.88	4.81
South Well	1.87	2.05	2.30	0.00	0.00	0.64	0.00	0.62	0.00	0.09	1.13	T	8.70	6.22	2.96
St. Nicholas	3.42	3.13	2.41	0.00	0.00	0.90	0.00	1.13	0.00	0.12	1.35	T	12.46	8.96	4.40
Stuart Well	2.17	2.74	2.66	0.00	0.00	0.73	0.00	0.59	0.00	0.09	1.15	T	10.13	7.57	4.34
West Well	4.10	1.52	2.69	0.00	0.00	0.48	0.00	0.86	0.00	0.09	0.97	T	10.68	8.31	3.68
Enclosure # 1	1.79	1.99	2.71	0.00	0.00	0.50	0.00	0.72	0.00	0.09	1.12	T	8.92	6.49	3.62
Enclosure # 2	2.72	2.17	2.71	0.00	0.00	0.51	0.00	0.77	0.00	0.10	1.19	T	10.17	7.60	5.28
Enclosure # 10	1.96	1.55	2.02	0.00	0.00	0.47	0.00	0.58	0.00	0.09	1.15	T	8.07	5.58	3.75
Average 18 Stations	2.10	2.18	2.50	0.00	0.00	0.58	0.00	0.75	0.00	0.10	1.29	T	9.49	6.79	4.36

RG
Period Study

December 15, 1928

Project: Period study of black grama, (Bouteloua eriopoda)

Scope: To determine the best seasonal use for Bouteloua eriopoda range in order to maintain this type at its highest productivity.

Status: Origional project established in 1922, and results reported including 1925. Reestablished in field in spring of 1926, and conducted according to working plan that year. Fourteen quadrats in connection were charted 1926 and 1927. Growth and utilization secured each season. Project carried during 1928 as partially inactive, owing to the small numbers of stock on the Reserve and resulting unsatisfactory utilization. All enclosures remained open during 1928.

Plans: With the larger breeding herd now on the Reserve, the project will be revived, and conducted during 1929 in accordance with the original work plan. Quadrats to be charted to show 1928 density changes.

Date of Completion: Indefinite.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Clipping Study
Tobosa Grass

December 27, 1928

Project: Clipping Study of Tobosa Grass (Hilaria mutica)

Scope: To determine by artificial methods the effect of different intensities of use with regard to frequency of harvesting and height of clipping above the ground level and forage volumne production, maintenance of density, height growth and plant vigor. To check these results against prior determinations.

Status: Project established in the field map 1925. Precipitation status established. Two series of four one meter quadrats laid out for the purpose of comparing close and moderate utilization. All quadrats clipped at specified intervals during the growing seasons. Flower stalk counts and leaf measurements made at time of clipping.

Records kept of the air dry weight of all forage harvested from each quadrat. Dates of beginning and ending of growing season recorded. Precipitation for growing season recorded. All quadrats charted at end of growing season of each year. Compilation of data brought up to date at close of each field season.

The accompanying table gives a summary of the data for the individual quadrats to date.

Further Work: The project to be continued as outlined in work plan. Publication of results as soon as the analysis brings out conclusive evidence.

Date of Completion: Indeffinite

Assignment: Jornada Range Experiment Station
Campbell and Canfield.

RG
Clipping Study
Black Grama Grass

December 27, 1928

Project: Clipping study Black Grama Grass (Bouteloua eriopoda.)

Scope: To determine by artificial methods the effect of different intensities of use on maintenance of density and forage production.

Status: Original series of 4 quadrats to be clipped at a height of two inches above ground established August 1925. Precipitation station established within the enclosure. A second series of four quadrats ("A" series) to be clipped at a height of one inch above ground was established inside the same enclosure at the close of the growing season of 1925. All quadrats are clipped at regular intervals which, according to the quadrat, vary from two weeks to once at the close of the growing season. Flower stalk counts are made at time of clipping. Height growth measurements are made at end of season. All quadrats are charted at end of the growing season. The air dry weight of the forage produced by each quadrat is weighed and recorded. All data is compiled and analyzed at the end of the field season.

The following tabulated data show the results of the experiment to date.

A discussion of some of the outstanding results are included in this report under Natural Revegetation.

Further Work: Project to continue as outlined in work plan.

Date of Completion: Indeffinite.

Assignment: Jornada Range Experiment Station
Campbell and Canfield.

RG
Gutierrezia Study

December 15, 1928

Project: Study of Gutierrezia on black grama (Bouteloua eriopoda) range.

Scope: To determine the outcome of competition between Gutierrezia spp. and Bouteloua eriopoda, under moderate and under proper utilization.

Status: Project established in the field July, 1924. Three one by three meter quadrats charted each fall, and extensive notes bearing on the problem have been taken. Progress reported annually until this year.

Results: The results show that under moderate grazing, Bouteloua eriopoda will eventually predominate in the type under investigation.

Further Work: Quadrats to be charted and complete records made each year in accordance with the work plan.

The four years data from the project as conducted under light grazing conditions, are to be compiled and analyzed with a view to the preparation of a progress report for publication.

The next five years of study under proper use of the type should bring out enough additional data for a final report on the project.

Date of Completion: About 1933.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Yucca Study

December 15, 1928

Project: Growth study of seaweed (Yucca elata.)

Scope: To determine the growth habits, characteristics, and rate of growth of Yucca elata.

Status: Project established in the field November, 1925, and carried through to date in accordance with 1925 work plan.

Observations reported annually. Work this year confined to measurements of stem and leaf growth. Stems continue to show a growth rate of about ½" to 1" per year on mature plants.

Further Work: When time and funds permit, this project is to be expanded in accordance with revised work plan of November 7, 1926.

Results to date to be compiled, analyzed and prepared for publication as press bulletin of the New Mexico State Agricultural College, since there is some demand for growth and reproduction data on Yucca elata.

Date of Completion: Indefinite.

Assignment: Jornada Range Reserve
R. S. Campbell.

RG
Plant Identification

December 15, 1928

Project: Plant collection and identification.

Scope: To complete a survey of the Jornada flora and to secure economic data for all species collected.

Status: Sixteen plant collections have been made on the Reserve, fifteen of which have been identified.

The fifteenth collection, made in 1927, consisted of 122 specimens: nine grasses, two grass like plants, eighty three forbs, and twenty eight trees and shrubs. Of these, twenty nine species were new to Forest Service range plant records, and nine species were second records for the Forest Service. The following eight genera were added to Forest Service records: Calvatia, Coprinus, Naucoria, Fendlerella, Nerisyrenia, Perityle, Sartwellia and Trianthema. Also, of the one hundred twenty two specimens in the collection, seventy eight were new to the Jornada collection.

The sixteenth Jornada collection, made in 1928, is as yet unidentified.

Further Work: Plant collections and economic notes to be secured each year.

Plant collection trips to be made to the Dona Ana Mountains, St. Nicholas, and Block Mountain when time permits.

Date of Completion: Continuous.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Carrying Capacity

December 26, 1928

Project: Carrying Capacity of semi-desert range in South Central New Mexico.

Scope: To determine the grazing capacity of semi-arid range in South Central New Mexico under different systems of management. To investigate the various factors effecting the grazing capacity and to measure their influence.

Status: Detailed pasture records are kept for each of the nine pastures of the Reserve. These records are continuous since 1915 and include actual use by animal, days feed, utilization, forage crop and condition of stock. Results of project from 1915 to 1919 published in U.S.D.A. Bulletins 588 and 1031. Work plan revised in 1927. Shoeller's manuscript on Carrying Capacity revised by Chapline and is now in manuscript form.

Intensive reconnaissance was made in 1916. Extensive reconnaissance was made in 1923. New intensive reconnaissance was made in 1928. Field work of 1928 reconnaissance lacks 15 man days of completion.

Detailed discussions of the outstanding results of this project to date are included in this report under the headings of Carrying Capacity, Natural Revegetation and Handling Stock.

Three new forage crop enclosures were built this year.

Further Work: Project to be continued in accordance with revised work plan.

Field work of reconnaissance to be completed early in February 1929. Compilation and analysis of data to be completed by July 1, 1929. Previous carrying capacity figures to be revised using the forage acre as the unit of carrying capacity instead of the surface acre.

Date of Completion: Continuous.

Assignment: Jornada Range Experiment Station
Campbell and Canfield

RG
Palatability and Utilization

December 15, 1928

Project: Palatability and utilization study of important forage plants on the Reserve.

Scope: To determine the relative palatability and proper degree of utilization of important forage plants, and to secure phenological and life history information for the species under observation.

Status: Notes were taken during the growing seasons of 1927 and 1928 at the Period study and on a one acre plot in Pasture. No new plots established this year.

Further Work: Study to be continued as outlined in work plan, with plots cut to one quarter acre in size. New plots to be established as they become necessary for the collection of adequate data.

Date of Completion: Indefinite.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RC
Rodent Control
(Cooperation U.S. Biological Survey)

December 15, 1928

Project: Eradication and control of range destroying rodents.

Scope: To accomplish the eradication and control of range destroying rodents, so as to prevent a reduction in carrying capacity from this cause.

Status: Treatment of prairie dogs and kangaroo rats by U.S. Biological Survey previously reported. Kangaroo rats and rabbits are a very serious problem on the Reserve, particularly when feed is scarce.

Further Work: With the injury that is still being done by range destroying rodents, estimates and recommendations have been made for treatment of the entire mesa portion of the Reserve, and for controlling the area after eradication. In case no further treatment is available from the Biological Survey, the poisoning of rodents and killing of rabbits on a small scale will be continued by the Station personnel at odd times.

Date of Completion: Indefinite.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Handling Stock
Calf Crop

December 15, 1928

Project: Increased calf crops in the Southwest.

Scope: To develop a method of handling breeding cattle which will increase the calf crop and reduce the cost of production.

Status: Complete records kept of all Jornada calf crops from 1916 to date. Best available estimates of calf crops on other ranges in southern New Mexico recorded during the same period. Results to date included in progress reports.

The calf crop for the grazing year 1928 was, as usual, a rather high figure for this locality. However, the tabulated results may be viewed in a more favorable light when it is explained that 66 barren cows were culled from the herd early in December, 1927--almost a year later than was origionally planned. Had these barren cows been in a marketable condition during the previous sales in February, they would have been eliminated from the breeding herd at that time and a much higher calf crop would have been obtained.

From a yearlong breeding herd of 604 cows, the following calves were raised: steer calves 228, heifer calves 259, or a total of 487, making a calf crop of 80.6%.

Further Work: Project to be continued with further increase in calf production as the objective.

Date of Completion: Continuous.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Handling Stock
Losses

December 15, 1928

Project: Management to avoid loss.

Scope: To develop methods that will result in the elimination or reduction of stock losses from all causes.

Status: Complete records kept of all losses on Reserve since 1915, and estimated losses on other of the region. Previous losses tabulated in progress reports.

During the grazing year 1928 with an average of 720.1 head of cows in the breeding herd there was a loss of 8 head or 1.1%. The loss of two head was attributed to poisonous plants, three to unknown causes, two were bogged down in surface tanks and one was killed by lightning. From a year-long average of 47.5 head of bulls, there was a loss of two head or 4.2%. The cause of the loss was not determined in either case. In both instances there were old T-hook bulls. The entire breeding herd yearlong average was 767.6 head, with a loss of 10 head of 1.3%.

Seven calves were reported dead. Six of these were found in Pasture 1 near Brown and Puddle Tanks. Their loss was attributed to poisonous plants. One was killed by lightning in Pasture 6.

In the cases of poisoning a diligent search was made for poisonous plants in the area near the carcass, but no evidence of the existance of any poisonous plant in sufficient quantity to cause such large losses was found. However, the suspicion that the loss was due to poison is well founded because the losses occurred within a restricted area and all were apparently healthy animals.

One horse was accidentally killed during breaking.

Further Work: Project will be carried on with the elimination of all loss from preventable scources as the objective.

Date of Completion: Continuous.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Predatory Animal Control
(Cooperation U.S. Biological Survey)

December 15, 1928

Project: The control of predatory animals.

Scope: To prevent the loss of stock and the destruction of game by predatory animals.

Status: One hundred twenty six coyotes were reported poisoned on the Reserve during 1927 by the Biological Survey. No further operations were conducted in 1928. Coyotes are not at present a serious factor in livestock losses, while they are admittedly a considerable aid in the control of rodents.

Further Work: The project will be carried on at such intervals as appear necessary to prevent losses of stock and game. It is anticipated that coyotes may be kept within proper limits by part time efforts of the Station personnel.

Date of Completion: Indefinite.

Assignment: Jornada Range Reserve
Campbell and Canfield

RG
Handling Stock
Costs

December 15, 1928

Project: Cost of Cattle Production.

Scope: To determine the relative cost of producing cattle under pasture and improved methods of management, as compared with cost on the open range.

Status: No new analysis of this project since Schoeller's article, "The Cost of a Range Calf," published in the October, 1927, "Producer."

Further Work: Cost data on various phases of work to be kept for Jornada operation, and similar data to be secured from adjoining ranges when possible.

Date of Completion: Continuous.

Assignment: Jornada Range Reserve
Campbell and Canfield.

RG
Improvement
in Grade

January 7, 1929

Project: Management to improve the general grade of range cattle in the Southwest.

Scope: To determine the most practical method of improving the grade of the range cattle of the Southwest.

Status: This study has been carried continuously since 1915. Improved methods of handling stock on the range have been adopted as a means of improving the quality of the Jornada herd and its product.

Purebred bulls only are used. The breeding herd is systematically culled of old and below standard or nonproductive animals. Culls replaced by purchase of young purebred bulls and selected heifer calves from the Jornada herd.

Heifers not bred until past 18 months old. Bulls seggregated except in breeding season, June 1 to December 1.

Date of Completion: Continuous.

Assignment: Campbell and Canfield.

RC
Reconnaissance

January 7, 1929

Project: To determine the grazing capacity of Southwestern ranges.

Scope: To place the carrying capacity of the Jornada Range Reserve on a forage acre basis and to determine the forage acre requirement for stock on similar ranges.

Status: First intensive reconnaissance in 1916 during the peak of forage productivity of the range. Check reconnaissance in 1922 during period of low forage production to determine effect of continued drought. Third reconnaissance 1928-29 during a second high point in forage production.

Reconnaissance figures to be checked against actual use, forage crop estimates and previous reconnaissances.

The accomplishment of the 1928-29 reconnaissance was made possible by the assistance of Rangers Vance Thomas, R. V. Galt, G. L. Wang and H. Garvin Smith. The high quality of work turned out by these men will be a big factor in the success of the project.

Date of Completion: Present reconnaissance field examination and compilation spring 1929.

Assignment: Campbell and Canfield.

RG
Solid Stems
in Grasses

January 7, 1929

Project: To determine the species of Southwestern grasses having solid stems and to discover the physiological and ecological significance of this condition.

Status: Study begun in 1927. 43 common forage species examined of which 84 % have solid stems at maturity. Main forage species all have solid internodes. Grasses having hollow stems occur only in more favorable habitat or protected places.

Material collected and preserved for the manufacture of microscopic slides. 1928 manuscript undergoing revision.

Date of Completion: Spring 1929, if time. is available.

Assignment: Canfield.